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Ionosonde tracking of infrasound wavefronts in the thermosphere launched by seismic waves after the 2010 M8.8 Chile earthquake

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Abstract

© 2016 American Geophysical Union. All Rights Reserved.Ionospheric disturbances associated with the M8.8 Chile earthquake (35.91°S, 72.73°W) on 27 February 2010 were observed at Kazan, Russia (55.85°N, 48.81°E). Rapid-run ionograms at 1 min intervals exhibited multiple-cusp signatures (MCSs) for more than 30 min, which have been observed several times after large earthquakes. The ionospheric disturbances were caused by infrasound propagating upward in the atmosphere, which modified the electron density distribution through ion-neutral collisions. The anomaly of the vertical electron density distribution responsible for the MCSs was analyzed by converting the ionogram traces into real height profiles. The density profiles at 1 min intervals allowed the tracking of the vertical propagation of infrasound and provided information on parameters of acoustic waves, which was not possible from the previous measurements such as standard ionograms at 5-15 min intervals, HF Doppler soundings, and total electron content using satellite beacon signals. The speed of acoustic waves in the thermosphere was evaluated from the consecutive ionograms with MCSs, and it was found that the thermospheric temperature was slightly higher than that calculated using the Mass Spectrometer and Incoherent Scatter Radar empirical model (NRLMSISE-00).

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Keywords

2010 Chile earthquake, infrasounds, ionosonde, multiple-cusp signature, Rayleigh waves, thermosphere